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The Impact of Monetary Policy on Economic Development: Evidence from Lao PDR

Khaysy Srithilat [α] & Gang Sun [σ]

Abstract- This paper examines the impact of monetary policy on the economic development by using annual time series data from 1989-2016. The unit root testing result suggests that all variables are stationary at first difference; therefore, the Johansen Cointegration and Error Correction Model has been employed to analyze the association between variables. The finding shows that money supply, interest rate, and inflation rate negatively effect on the real GDP per capita in the long run and only the real exchange rate has a positive sign. The error correction model result indicates the existence of short-run causality between money supply, real exchange rate and real GDP per capita.

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I. Introduction

Monetary policy is a key factor of macroeconomic management in opened economy to stimulate economic stability and to promote economic development through its impact on economic variables. It is generally believe that monetary policy influences macroeconomic variables which include employment creation, price stability, gross domestic product growth and equilibrium in the balance of payment in developing country (Anowor & Okorie, 2016; Precious, 2014). The role of monetary policy on the economic development and the changing in aggregate economic activity depend on how monetary policy is conducted and the independency of the central bank to choose the appropriate monetary tools to formulate the monetary policy of macroeconomic objectives (Alavinasab, 2016). The accurate information on the effectiveness of the policy on the macro economy is the main issue of the policy maker to successfully implementation of any economic policy in general to achieve the sustainable output growth, the authority and policy maker always targets on the intermediate variables include the short-term interest rate, money supply, and exchange rate, which is considered as the most powerful instrument of monetary policy(Artus & Barroux, 1990; Fasanya, Onakoya, & Agboluaje, 2013).

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Though many literatures and empirical studies supported the effectiveness of monetary policy on the macroeconomic variables but some argued that changing in money supply changes only the of nominal magnitude gross domestic product and it does not have any effect on the real economic variables, further more, rising of the money supply can only lead inflation such as: (Friedman, 1995; and Jeffrey M. Lacker, 2014). The recent empirical study of more than 100 countries by (Romer & Romer, 2002) the correlation between money supply and real economics activities found in only developed countries.(Lashkary & Kashani, 2011) study on the impact of monetary variables on economic growth in Iran by using monetarist's approach, the finding suggests that there is no relationship between money and real economic variables such as gross domestic product, employment. Nevertheless, the consensus of the role of monetary policy on the economic development and the real economic activity are not conclusively on the macroeconomic policy research context.

Since Lao People's Democratic Republic had changed its policy from centrally planned economy to market-oriented economy in 1986, the Bank of Laos (BoL) has played an important role boosting economic activities and economic stability. The transition toward a market oriented-economy was accompanied by the expansion on monetary policy, that can be seen by the money supply as the proportion of gross domestic product increased rapidly from 20% in 1999 to 58% in 2015 and interest rate decreased from 30% in 1990 to 20% in 1999 and 3.5% in 2015 respectively, the annual gross domestic product grew up by 8% averagely. Nevertheless, the Lao economy also suffered high fluctuation of inflation and dollarization continuously. During the Asian financial crisis; inflation rate hit the new historical record at 128% in 1999. The exchange rate mechanism is not reflex the actual economic condition due to the existence of high dollarization, the percentage of foreign currency as the proportion of aggregate money supply hit 72% and 80% in 1998 and 1999. The monetary policy is limited and incomplete[1]. It is mainly base on issuing bond and reserve requirement in order to serve the government economic policy and economic liquidity. Therefore, this study aims to analysis

[1] Somphao Phaysith, Bank of Lao PDR

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the impact of monetary policy on the economic development in Lao PDR, Despite, the percentage of using foreign currency and the inflation rate has been decreased recently, and the Lao economy continues to benefit with high level of economic growth. In order to stimulate sustainable growth in the long run and maintain the economic stability, the Lao authority and policy makers needs better understand on the crucial effectiveness of monetary policy instruments on macroeconomic variables deeply.

II. Literature Review

Monetary is geared toward achieving the economic growth and economic performance. The earlier empirical study such as (Zhang & Sun, 2017) analysis the confidence in monetary policy in China response by the entrepreneur. the private sector will had more inspiration when the central bank adapt an easing monetary policy, thus leads to better economic environment and higher economic growth. (Alavinasab, 2016) examine the impact of monetary policy on economics growth in Iran by using time series data which appropriate with error correction model (ECM), the finding of regression show that money supply, exchange rate and inflation had a long run significantly relationship on economics growth (Anowor & Okorie, 2016) also adopting the error correction model with time serried data from 1982-2013, the result show that increasing on cash reserve ratio led to increase in economic growth in Nigeria, which supports the study of the previous literature (Fasanya et al., 2013) found that : inflation, exchange rate, and external reserve are important force driving economic growth in Nigeria, (Sylvie NIBEZA, 2015) deployed on Johansen for integration and Vector Error Correction to check the existing for long run association between variable , the result of the analysis found that there is an integration among variable , exchange rate and money supply had a significantly effect on economic growth of Rwanda. (Fernald, Spiegel, & Swanson, 2014) examine the monetary effectiveness in China, the finding indicates that increases in bank reserve requirements reduce economic activity and changes in interest rates also have the impacts on economic activity and price level, (Gul, Mughal, & Rahim, 2012) found that interest rate has negative impact on the output and he also found that money supply has strongly positive impact on the output, which supports (Alavinasab, 2016; Fasanya et al., 2013; Sylvie NIBEZA, 2015), (Bollard & Hunt, 1960) suggests that New Zealand's monetary policy framework is likely to have played a role in lifting economic performance, along with many other factors, most notably the widespread economic reforms. (Precious, 2014) investigates the impact of monetary policy in promoting economic growth in the South African economy over the period 2000-2010, by using Johansen co-integration and the Error Correction Mechanism to identify the long-run and short-run dynamics between variables. The finding shows that money supply, repo rate and exchange rate had the positive impact on economic growth in South African countries.

(Jeffrey M. Lacker, 2014) agree with (Friedman, 1995) Argued that monetary policy can determine the long-run path of inflation, but its effect on real economic activity is limited and temporary. The contribution of central bank to economic growth is very low. The transmission process can be expressed through the IS-LM model. For example, if the central bank uses expansionary monetary policy by open market leads to right ward shift in LM curve, it is meaning that interest rate decreases and the gross domestic product goes up. However, these consequences is considered as the immediate short-run effect of monetary policy , then the price level would increase, thus the LM curve snapping back gain. (Artus & Barroux, 1990) and (Cover, 1992) using monthly data from 1951-1087 examine the symmetric effect of positive and negative of money supply shock, the finding implied that uncertainty about the future path of money supply has a negative impact on the output, (Romer & Romer, 2002) studies 110 countries over a 30 year period, the finding suggests that growth rate of money supply are very high, but there is no correlation between money supply and output in many countries, accept for some developed countries. (Babatunde & Shuaibu, 2011) Examines money supply, inflation and economic growth in Nigeria, the finding shows negative relationship between inflation and economic growth, (Bhattarai, 2011) investigated on impact of exchange rate and money supply on growth, inflation and interest rate in the UK found that depreciation of Sterling and higher interest rate have negative impact on economic growth (Ehigiamusoe, Uyi Kizito, 2013) studied on The Link between Money Market and Economic Growth in Nigeria: using the Vector Error Correction Model Approach found that money supply is significantly negative impact on economic growth and the link between money market and the real sector is very weak. (Vimaly Savannarideth, 2015) examine the money-output Granger causality in Lao PDR found that money supply does not Granger-cause output.

On the other hand, some researchers found there is no relationship between monetary policies on real economic growth. (Ho & Yeh, 2010) examined on monetary policy for a small open economy with heavily managed exchange rates with sign restrictions to the Taiwanese case, where existing studies found no clear effect of monetary policy shocks on the output and price level (Khabo & Harmse, 2005) studied on evaluates the impact of monetary policy on the economic growth of a small and open economy of South Africa , the finding show : money supply and inflation are not significantly related to the change of economic growth, (Babatunde

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& Shuaibu, 2011) Also confirmed there is no relationship between money supply and economic growth.

III. Data and Methodology

To analysis the impact of monetary policy on economic development in Laos, the time serried data established by World Bank, world development indicator (WDI 2015) and the annual time serried data from an annual economic report of the Bank of Lao PDR (BoL) from 1989-2016[2] have been taken to analyze the relationship between variables. The specific model can be formulated as below:

$$GDP = f(M2, REX, IR, INF) \quad (1)$$

To transform the above model (3) to a multiple regression form can be written like this:

$$GDP = \beta_0 + \beta_1 M2 + \beta_2 REX + \beta_3 IR + \beta_4 INF + \varepsilon \quad (2)$$

Where GDP is real gross domestic product per capital, $M2$ is broad money, REX is real exchange rate USD/Kip, IR is the interest rate, INF is inflation rate, ε is error term, β_0 is intercept, $\beta_1, \beta_2, \beta_3, \beta_4$ is the coefficient of the independent variable.

In presence study, we have used time series data, therefore, checking for stationary technique needs to apply to check whether all series stationary or not. Regarding to the previous study found that most of the economic time series data are found to be non stationary and a non-stationary time series may produce spurious regression, (Phillips & Perron, 1988).

a) Unit Root Test

This study employs the Augmented Dickey-Fuller (ADF) test as test of unit root to check the stationary of the series in order to avoid spurious regression problem. The testing is base on the assumption of serially correlated error terms, which their contribution considers with intercept and with intercept and trend. The ADF test is specific as:

$$\Delta Y_t = \alpha_0 + \gamma Y_{t-1} + \alpha_2 t + \sum_{i=1}^{\rho} \emptyset \, \Delta Y_{t-1} + \varepsilon_i \quad (3)$$

Table 1: Unit Root test

Variable	ADF			
	Level		First difference	
	Intercept	Trend & intercept	Intercept	Trend & intercept
GDP	-1.77003 (1)	-1.3551 (0.0897)	-2.655729 (0.1931)	-3.646583* (0.0388)
IR	-1.681742 (-.4288)	-1.862036 (0.646)	-4.455371** (0.00017)	-4.619912 (0.0055)
INF	-2.795595 (0.0722)	-3.54485 (0.0552)	-5.10645** (0.0004)	-4.980416** (0.0002)
M2	-2.071664 (0.2568)	-1.468972 (0.8143)	-2.594819 (1.0683)	-4.675812** (0.00076)
REX	-1.630776 (0.4532)	-1.742369 (0.7029)	-2.201475 (0.2105)	-2.125487* (0.0346)

Note: The value in () is macKinnon (1996) one-side p-values
** And ** significant at 5% and 1% respectively.*

The ADF unit root test confirm the stationary of interest rate (IR) in the first difference of intercept with significant level at 1% , and also confirmed significantly the stationary of real gross domestic product per capita, broad money and real exchange rate in first difference with trend and intercept at significant level at 1% for M2 and INF at 5% for GDP and REX. Since checking all time series data indicates that all series are stationary in first difference, consequently, the Johansen cointegration and Error Correction Model (VECM) are appropriate technique to analyze the impact of monetary policy on economic development in Lao PDR.

Table 2: Lag length selection

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-1080.425	NA	1.26E+30	83.49421	83.73615	83.56388
1	-875.9335	314.6018	1.32E+24	69.68719	71.13884	70.10521
2	-827.4592	55.93187*	2.76e+23*	67.88148*	70.54283*	68.64785*

*Notes: * Indicates lag order selected by the criterion: sequential modified LR test statistic LR; final prediction* error FPE; Akaike information criterion AIC; Schwarz information criterion SC; Hannan–Quinn information criterion HQ at significant level at 5%.

[2] The statistic center of Lao PDR has been starting record time series data from 1989.

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b) Johansen Cointegration

The study has used Johansen's cointegration test according to the above unit root testing result and the comparative advantage of Johansen integrated technique that can be applied when there are more than three variables in the model. The Maximum Likelihood testing procedure has been developed by (Johansen, 1988) and (Johansen & Juselius, 1990) including the VAR of order p. The form of equation can be formulated below:

$$\Delta Y_t = \delta_1 Y_{t-1} + \cdots \delta_k \Delta Y_{t-k+1} + \Pi Y_{t-k} \varphi + e_t \qquad (4)$$

Where δ_k and Π are coefficient matrices, and determination of the rank (r) of matrix δ_k is the main point of conducting the cointegration procedure that developed by Johansen. The feasible outcome of integration equation includes: 1. Full rank $(r = n)$, 2. $(r = 0)$ and finally, when there are at most r co-integrating vectors $(0 \leq r \leq n)$. Johansen's cointegration procedure deals with two likelihood ratio test statistics such as trace test and the maximum eigenvalue test.

Table 3: Johansen Cointegration test result.

Null Hypothesis	Alt Hypothesis	Trace test	Critical value	Prob
$r = 0$	$r > 0$	184.336**	69.81889	0
$r \leq 1$	$r \geq 1$	114.3727**	47.85613	0
$r \leq 2$	$r \geq 2$	64.03572**	29.79707	0
$r \leq 3$	$r \geq 3$	26.47584**	15.49471	0.0008
$r \leq 4$	$r \geq 4$	6.195244*	3.841466	0.0128
Null Hypothesis	**Alt Hypothesis**	**Max Eigenvalue**	**Critical value**	**Prob**
$r = 0$	$r \neq 0$	69.96326*	33.87687	0
$r = 1$	$r \neq 1$	50.33702*	27.58434	0
$r = 2$	$r \neq 2$	37.55988*	21.13162	0.0001
$r = 3$	$r \neq 3$	20.28059*	14.2646	0.005
$r = 4$	$r \neq 4$	6.195244*	3.841466	0.0128

- Trace test indicates 5 cointegrating eqn(s) at 5% and 1%
- Max eigenvalue test indicates 5 cointegrating eqn(s) at 5% and 1%
** and **: denotes rejection of the hypothesis at 5% and 1% respectively.*

Table 3 is observed that both Trace test and the Max-Eigenvalue test indicates 5 cointegrating equation at 5% level of significance. The null hypothesis of no cointegration has been rejected. Hence there exist the long run association among all variables.

Table 4: Long Run Model Based on normalized Cointegrating Coefficient

Dependent variable: *GDP*			
Variable	Coefficient	Standard Error	t-Statistics
M2	-22.22802*	-7.0817	-3.138797181
REX	135.3105*	-16.163	8.371413193
IR	-79128.65*	-14172	5.58344976
INF	-34372.26*	-3868.1	-8.886083607

*Note: * significantly.*

Table (4) exists the long run dynamic relationship of monetary policy variables on the real gross domestic product per capita. Rising on money supply decreases the real gross domestic product per capital as it has the negative sign and statistically significant. The long run relationship base on the normalized cointegrating coefficient analysis indicates that the broad money supply increases by 1 billion Kip, while keeps the others factor constant, real gross domestic product per capita would decrease 22.22 kip (or 0.003 US dollar)[2]. Even though money supply has an impact on real GDP per capital, but the degree of its relationship is very weakly compare with another variables.

The negative sign of money supply is also confirmed by the negative relationship of inflation rate on the real gross domestic product per capita, 1% increase in inflation would cause to decreasing on real GDP per capita by 34373.36 kip, due to Laos experienced with

[3] 1 USD is exchanged rate approximately 8000 kip in December 2016

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high inflation for several years continuously. Since the beginning of its transformation from centrally planned economy to the market-oriented economy in 1986, the Lao government has used expansionary monetary policy to boost its economic development that would leads Laos faces with high inflation rate increased up to 61% in 1989 and 35% in 1990. During the Asian economic crisis in 1997, the inflations rate was hit new historical record again up to 90% and 128% in 1998 and 1999. This phenomenon supports the finding on long-run relationship between money supply, inflation and real GDP per capita of Laos and confirms the previous literature which suggested that increasing money supply could not try to attend long term output. The results would only be the progressively increasing cycle of higher inflation (Friedman, 1995), (Felices & Tuesta, 2013)(Khabo & Harmse, 2005)(Langdana, 2009)(Jeffrey M. Lacker, 2014).

The real exchange rate is positively affect on real gross domestic product per capita, 1 unit depreciation on domestic currency between Lao kip and US dollar would increase 135.3105 kip on real GDP per capita due to domestic currency depreciation would make the price of export goods cheaper, thus increasing the number of total export significantly. Meanwhile, the interest rate is the most powerful variable influences on real GDP per capita; the relationship between interest rate and the real gross domestic product is the negative sign. By 1% increase of interest rate would decreases 79128.65 Kip of annual real GDP per capital of Laos. The finding also confirmed the previous literatures such as: (Friedman, 1995), (Friedman et al., 1974) and (Alavinasab, 2016), (Vimaly Savannarideth, 2015)(Lashkary & Kashani, 2011).

c) Granger Causality Test Based on Vector Error Correction Mechanism (VECM)

The short-run relationship between variable can be examined by the subsequent vector error correction model (VECM) as equations below:

$$\Delta GDP_t = \theta_0 + \sum_{i=1}^{p} \theta_1 \Delta M2_{t-i} + \sum_{i=1}^{p} \theta_2 \Delta REX_{t-i} + \sum_{i=1}^{p} \theta_3 \Delta IR_{t-i} + \sum_{i=1}^{p} \theta_4 \Delta INF_{t-i} + ECT_{t-1} + \mu_t \quad (5)$$

$$\Delta M2_t = \theta_5 + \sum_{i=1}^{p} \theta_6 \Delta DP_{t-i} + \sum_{i=1}^{p} \theta_7 \Delta REX_{t-i} + \sum_{i=1}^{p} \theta_8 \Delta IR_{t-i} + \sum_{i=1}^{p} \theta_9 \Delta INF_{t-i} + ECT_{1t-1} + \mu_{1t} \quad (6)$$

$$\Delta REX_t = \theta_{10} + \sum_{i=1}^{p} \theta_{11} \Delta GDP_{t-i} + \sum_{i=1}^{p} \theta_{12} \Delta M2_{t-i} + \sum_{i=1}^{p} \theta_{13} \Delta IR_{t-i} + \sum_{i=1}^{p} \theta_{14} \Delta IR_{t-i} + ECT_{2T-1} + \mu_{2t} \quad (7)$$

$$\Delta IR_t = \theta_{15} + \sum_{i=1}^{p} \theta_{16} \Delta GDP_{t-i} + \sum_{i=1}^{p} \theta_{17} \Delta REX_{t-i} + \sum_{i=1}^{p} \theta_{18} \Delta M2_{3t-i} + \sum_{i=1}^{p} \theta_{19} \Delta INF_{t-i} + ECT_{3t-1} + \mu_{3t} \quad (8)$$

$$\Delta INF_t = \theta_{20} + \sum_{i=1}^{p} \theta_{21} \Delta GDP_{t-i} + \sum_{i=1}^{p} \theta_{22} \Delta REX_{t-i} + \sum_{i=1}^{p} \theta_{24} \Delta M2_{3t-i} + \sum_{i=1}^{p} \theta_{23} \Delta IR_{t-i} + ECT_{4t-1} + \mu_{4t} \quad (9)$$

where Δ is the first difference , ECT is error correction term or speed adjustment to the long term equilibrium, $\theta_0 - \theta_{23}$ are intercept and short run coefficient , μ is error term, p is lag length.

The VECM equation (5)-(9) is used to explain the short run causality regarding to the standard Granger causality testing approach. The equation (6) investigates the causation between explanatory variable (money supply, interest rate, exchange rate and inflation) to gross domestic product per capita. It exists the long run causality among variable, if the coefficient of the error term becomes negative and significant, therefore, the joint F-value or Wald statistic (x^2) of each equation is used to identify the short run Granger causality with lag 2 of each equation. Before running the Granger causality testing, the diagnostic test by Breusch- Godfrey Serial Correlation LM Test, Jarque-berla test and heteroskedasticity (ARCH) are applied on all equations to check for the standard assumption of the model. The result of the Granger causality test base on the vector error correction model VECM are summery in the table 5.

Table 5. Multivariate Granger Causality Tests Based On Block Exogeniety Wald Tests

Dependence Variables	Independence Variables					$\sum x^2$	$ECT(-1)$
	ΔGDP_t	$\Delta M2_t$	ΔREX_t	ΔIR_t	ΔINF_t		
ΔGDP_t	-	10.7735** [0.0046]	5.706* [0.0477]	1.1060 [0.575]	3.8034 [0.1493]	19.366* [0.0130]	-0.164* [0.0129]
$\Delta M2_t$	8.1687* [0.0168]	-	2.3338 [0.3113]	2.2652 [0.3222]	0.3457 [0.8412]	18.9445* [0.0152]	-0.0059 [0.8163]
ΔREX_t	3.6943 [0.1577	0.8552 [0.6521]	-	0.9695 [0.6158]	11.5274** [0.0031]	22.678** [0.0038]	0.0022* [0.0246]
ΔIR_t	7.9586* [0.0187]	4.2840 [0.1174]	11.0615** [0.0040]	-	3.3793** [0.0092]	16.597* [0.0346]	-1.26* [0.040]

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ΔINF_t	1.293 [0.5238]	1.4781 [0.4776]	1.5996 [0.4494]	0.1310 [0.9366]	-	10.3466 [0.245]	5.27 (0.119)

*The value in [] is p statistic * And ** significant at 5% and 1% respectively*

The negative sign on error correction term appearing in the GDP equation and it is statistically significant at 5%. That means there is a long run causality running from monetary policy to economic development in Laos. Table 5 shows the x^2 statistic for both individual and joint significant of variables. In case of equation GDP, the joint x^2 implied that there exist the short run causality between explanatory variables and dependent variable. The individual x^2 is also significantly for Money supply M2 and real exchange rate REX, but not for interest rate IR and inflation INF.

IV. Conclusion

The present study attempts to examine the impact of monetary policy on Lao economy using Johansen cointegration and Vector Error Correction Mechanism (VECM). The finding reflexes the actual economic condition of Lao PDR. The finding revealed that changing on the stock of money supply would have a negatively effect on the economic development in the long run. The relationship between money supply and gross domestic product per capita is negatively significant. Moreover, the crucial element of monetary policy instrument which driven the economic development of Lao PDR in the long run are interest rate and exchange, these two independent variables have a positive sign and their contribution to gross domestic product per capita are much more higher than money supply, the long run coefficient of interest rate and real exchange are 79128.65 and 34372.25 respectively. However, the long-run relationship between inflation also confirms the negative relationship between money supply and real gross domestic product per capita, meaning that whenever the money supply has been rising would increase inflation and decreases in real output (Friedman et al., 1974)(Jeffrey M. Lacker, 2014). Meanwhile, the Granger causality base on the error correction model indicates that money supply and real exchange rate have a short run causality relationship with gross domestic product per capita. According to the result of this study suggests that the Lao authority needs to reconsider to apply on monetary policy to boost economic development by employ the most effective instrument as interest rate and the exchange rate rather than purely increase of money supply, due to avoiding negative impact of hyperinflation in order to maintain the economic stability and economic development in the long run.

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